

2023 Scenathon results

Pathways for food  
and land-use systems  
in the Rest of Non-  
EU region



**FABLE**  
CONSORTIUM



### **About FABLE**

The Food, Agriculture, Biodiversity, Land-Use, and Energy (FABLE) Consortium is a collaborative initiative to support the development of globally consistent mid-century national food and land-use pathways that could inform policies towards greater sustainability. The Consortium brings together teams of researchers from 24 countries and international partners from the UN Sustainable Development Solutions Network (SDSN), the International Institute for Applied Systems Analysis (IIASA), the Alliance of Bioversity International and CIAT, and the Potsdam Institute for Climate Impact Research (PIK). <https://www.fableconsortium.org/>

### **About the authors**

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### **Recommended citation**

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### **Countries in the “Rest of Non-EU” region**

Albania, Belarus, Bosnia and Herzegovina, Iceland, North Macedonia, Republic of Moldova, Montenegro, Serbia, Serbia and Montenegro, Switzerland, Ukraine.

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Our food and land-use systems are critical for staying within our planetary boundaries and the Earth’s system resilience. Among the six Transformations required to achieve the Sustainable Development Goals (SDGs), the fourth Transformation—focusing on food, land, and water—is crucial. This Transformation is key to achieving SDG 2 (Zero Hunger), SDG 6 (Clean Water and Sanitation), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), SDG 14 (Life Below Water), and SDG 15 (Life on Land). Moreover, it significantly supports the remaining SDGs, underscoring its crucial role in fostering a sustainable future.

In this document, we present the results of the 2023 ‘Scenathon’, a modelling exercise by the FABLE Consortium exploring three alternative futures for national and regional food and land-use systems. The term ‘Scenathon’ stands for ‘a marathon of scenarios’ and refers to FABLE’s iterative process for ensuring that national and regional pathways have coherent trade assumptions and align with global sustainability targets (see the 2024 Sustainable Development Report for more information).

Through these long-term pathways, we can identify trade-offs and synergies between different goals and see the impact of various actions, as well as key levers for guiding sustainable development policies through 2030 and 2050. These results, together with our modelling tools and methods, are designed to support decision-making and the development of better policies and targets to drive the transformation of our food and land-use systems.

Countries in the “Rest of Non-EU” region: Albania, Belarus, Bosnia and Herzegovina, Iceland, North Macedonia, Republic of Moldova, Montenegro, Serbia, Serbia and Montenegro, Switzerland, and Ukraine.

Figure 1. Historical share of GHG emissions from Agriculture, Forestry, and Other Land Use (AFOLU) to total AFOLU emissions and removals by source in 2020

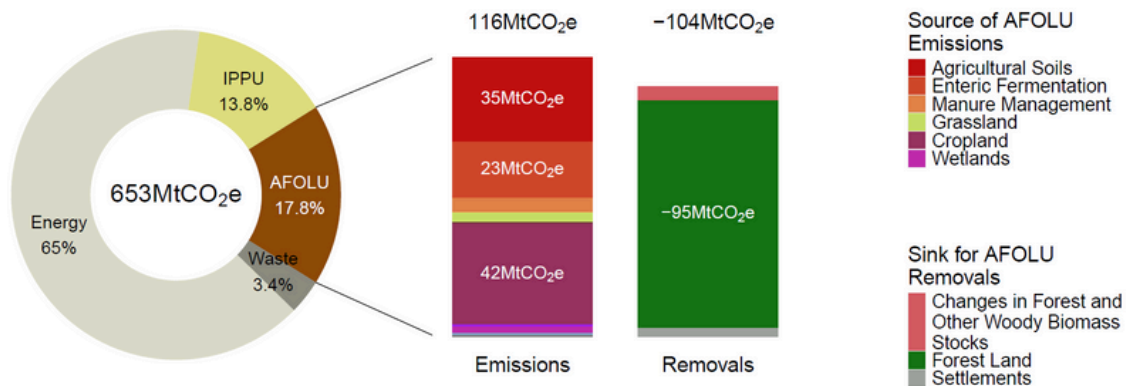
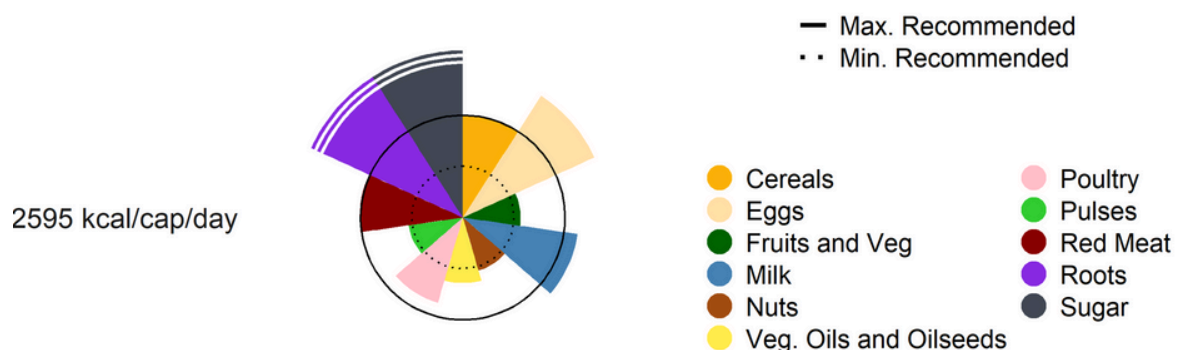







Figure 2. Daily average kilocalorie intake per capital per food category in 2020



This table summarizes regional targets for food and land use, derived from regional commitments, policies, and strategies. It provides an overview of the region's current ambitions to transform its food and land-use systems. If the region lacked quantitative national targets, we have estimated targets based on qualitative pledges.

SDG	Indicator	Regional Target
 2 ZERO HUNGER	Undernourishment	Improve the availability of healthy and balanced food for <u>all</u>
	Diet-related diseases	Improving the national nutrition system in <u>schools</u> .
	Other food-related targets	Development of a national system of responsible consumption, reduction of food losses and reduction of <u>waste</u> .
 13 CLIMATE ACTION	Agriculture GHG emissions reduction	Development of a system of voluntary measurement, reporting and verification of <u>GHG</u> + national platform of carbon in agriculture
	Other climate mitigation related targets	Increasing the share of bioenergy in the national energy balance. Promoting the use of technologies aimed at reducing the use of fossil fuels in food <u>systems</u>
 15 LIFE ON LAND	Expand cropland area under agroecological practices	Limit adverse environmental impacts, especially on climate and biodiversity and foster the adaptation of the agriculture sector to changing overall climatic conditions. For this purpose, the principles of agroecology are used to enhance the resilience of the food <u>system</u> .
	Promote afforestation	Sum of 6,000 Mha by <u>2050</u>
	Reduce or halt use of agrochemicals and other agricultural practices that harm biodiversity	Capacity building in the field of chemical pesticides circulation with an emphasis on post-registration <u>compliance</u>
	Other biodiversity related targets	Adapt to climate change and promote biodiversity and <u>agrobiodiversity</u> . The growth of organic production is ensured and supported.
 8 DECENT WORK AND ECONOMIC GROWTH	Agricultural exports	Promotion of Ukrainian agricultural products and food products in foreign markets. Export increase by factor of 1.5 from 2035-2050 (assumption)
	Timber exports	Ensure the sustainable use of water, land, and forest <u>resources</u> .
	Employment in the agricultural sector	Extensive training of small agricultural producers in the latest technologies, especially climate neutral. Establishment of a national system of advisory services and organized product promotion <u>chains</u> .
 14 LIFE BELOW WATER	Limit water use	Ensuring the closed cycle of water resources use (including reuse of prepared water from domestic treatment plants for irrigation) in all food production <u>chains</u>
	Limit N and P use	Improving the fertilizer management <u>system</u>

## Model

Using the open-access [FABLE Calculator](#) and the FABLE decentralized modelling infrastructure, we have developed three alternative pathways —Current Trends, National Commitments, and Sustainable Pathway— to explore the impact of various practices and policies on achieving sustainability targets through 2050. We compare our results with targets across food security and nutrition, GHG emissions reduction, forest and biodiversity conservation, and sustainable use of water, nitrogen, and phosphorus.

For each of these pathways, we have established various assumptions regarding the evolution of several model parameters. These parameters include population growth, dietary patterns, food waste, food import and export levels, crop and livestock productivity, agricultural expansion, afforestation, livestock density, protected areas expansion, post-harvest losses, biofuel demand, urban expansion, agricultural practice coverage, and irrigation area expansion. These assumptions detail the extent to which these factors will drive changes in food and land systems from 2020 to 2050.

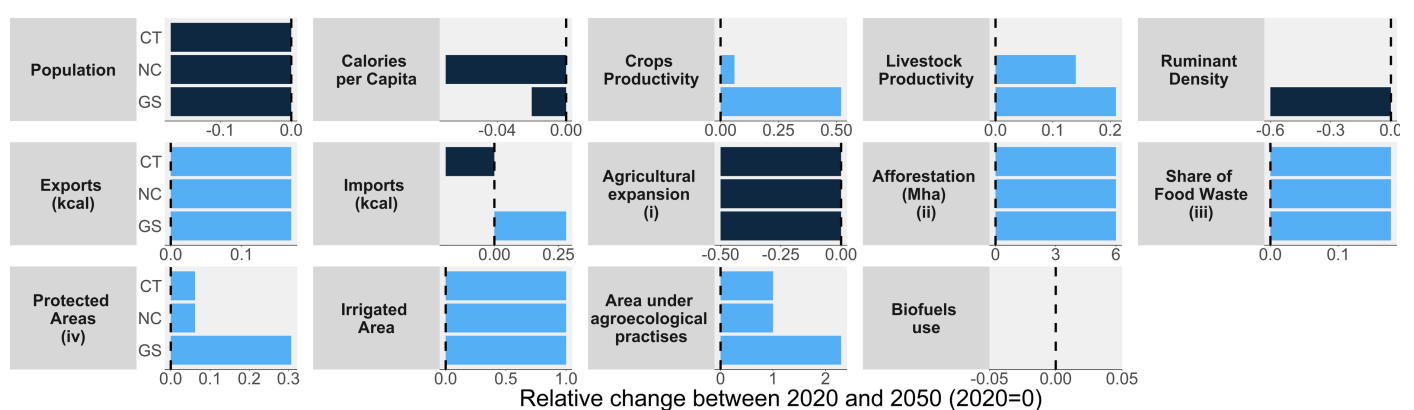
## Pathway narratives

**Current Trends:** Represents current situation. For trade, we choose no adjustment to reflect current disruptions due to the Ukraine – Russia conflict.

**National Commitments:** Attempts to predict how food and land systems will evolve if national strategies, pledges, and targets concerning climate, biodiversity, and food systems are met. This is based on a review of policy documents that describe the national climate and biodiversity strategies, the UN food system pathway, the national dietary guidelines, and other relevant policy documents for food and land systems.

**Global Sustainability:** Scenario selections reflect the same selections as in National commitments. Diet scenario which was set to EAT-Lancet Average.

Figure 3. Assumptions on the levers for change in each pathway



**Notes:** (i) Results are expressed in code, taking the value 1 for 'Free expansion scenario', -0.5 for 'No deforestation' and -1 for 'No Agricultural expansion'.  
 (ii) Results are expressed in a net increase rather than relative change.  
 (iii) Results are expressed % of consumption that is wasted.  
 (iv) Results are expressed in % of total land in 2050.

Figure 4. Computed daily average intake per capita over 2000-2050

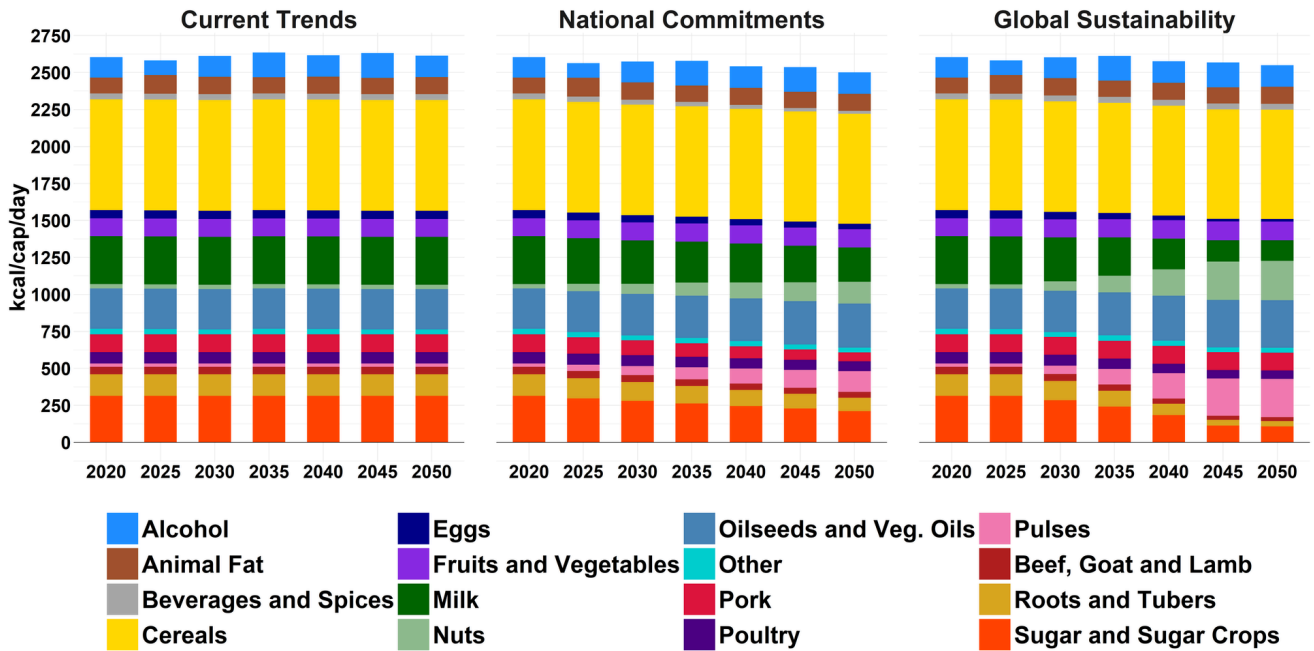


Figure 5. Comparison of the computed daily average kilocalorie intake per capital per food category across the three pathways and the prevalence of undernourishment in 2050

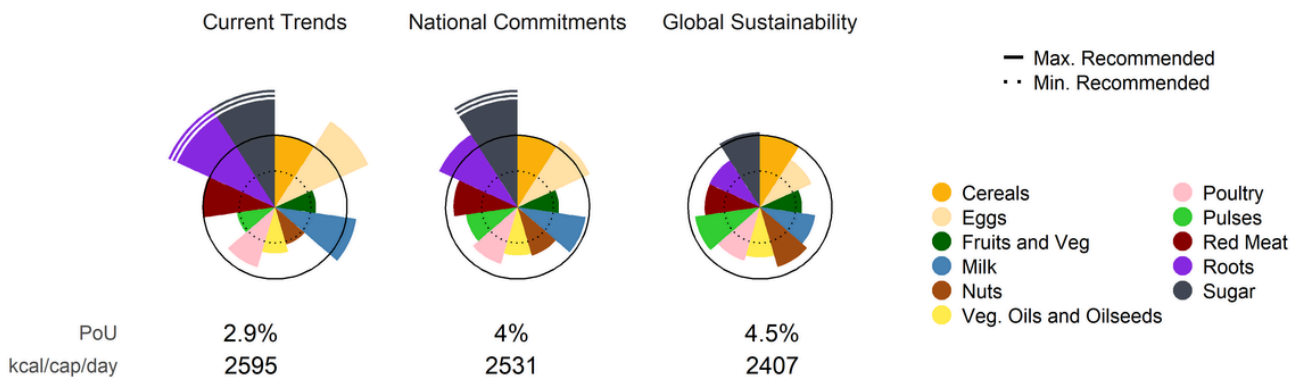


Figure 6. Evolution of land cover 2000-2050

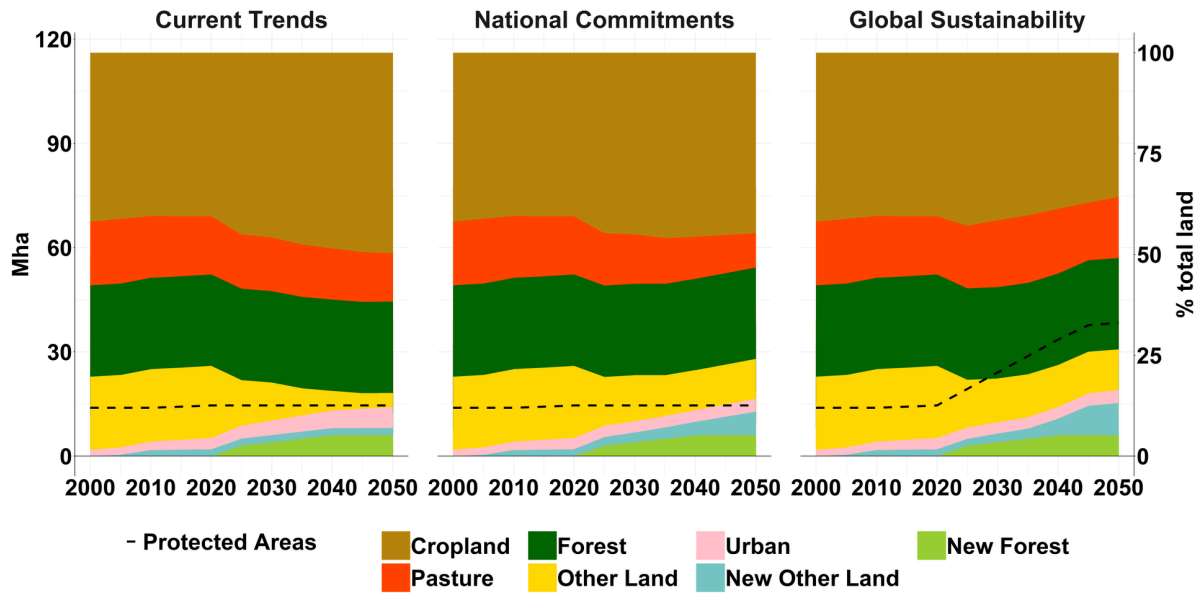


Figure 7. Evolution of the cropland composition 2000-2050

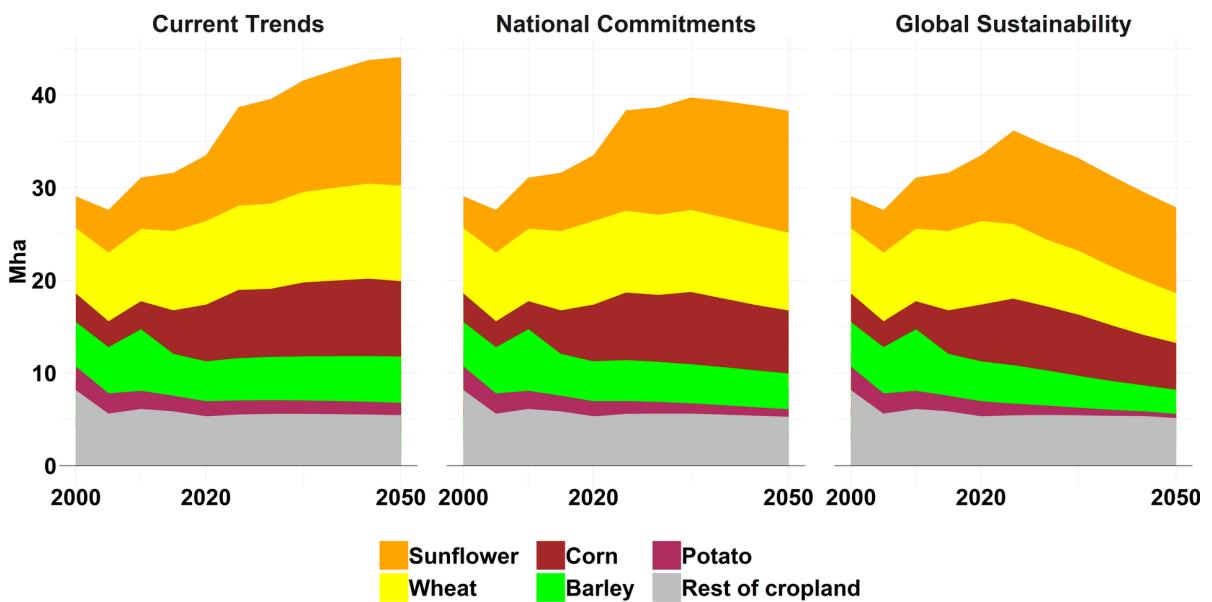


Figure 8. Projected AFOLU emissions and removals between 2020 and 2050 by main sources and sinks across pathways

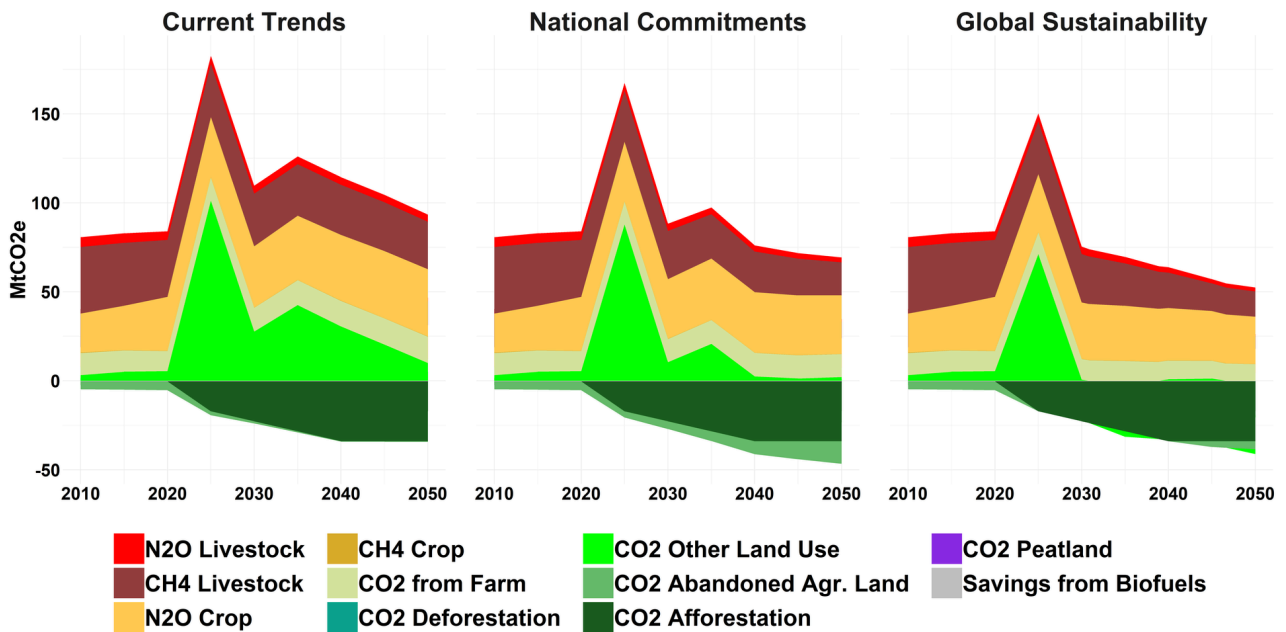


Figure 9. Share of cropland under agroecological practices

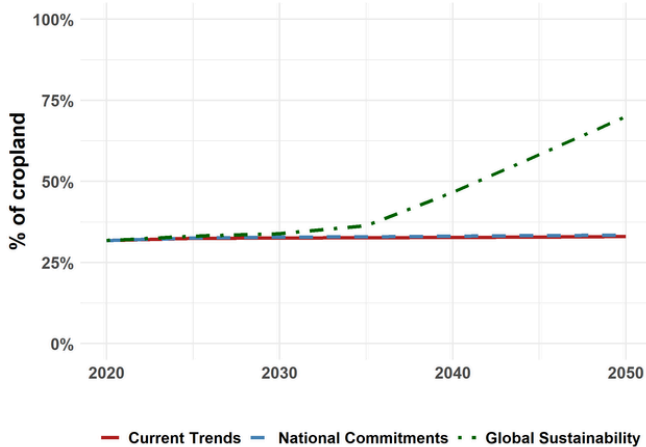
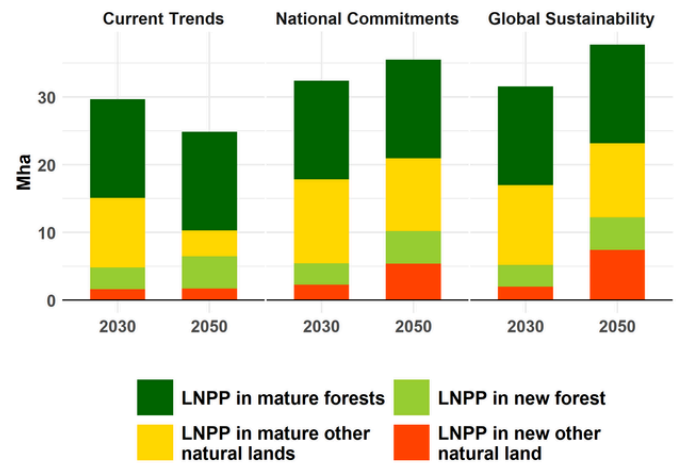


Figure 10. Total area of land where natural processes predominate (LNPP)



Agroecological practices included: Cover crops, cultivar mixtures, diversified farming systems, embedded natural, organic farming, no/minimal tillage.



Figure 11. Nitrogen application

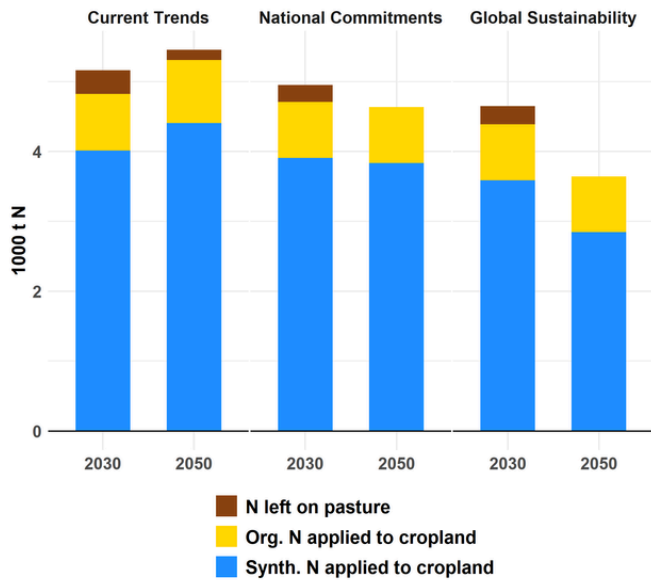
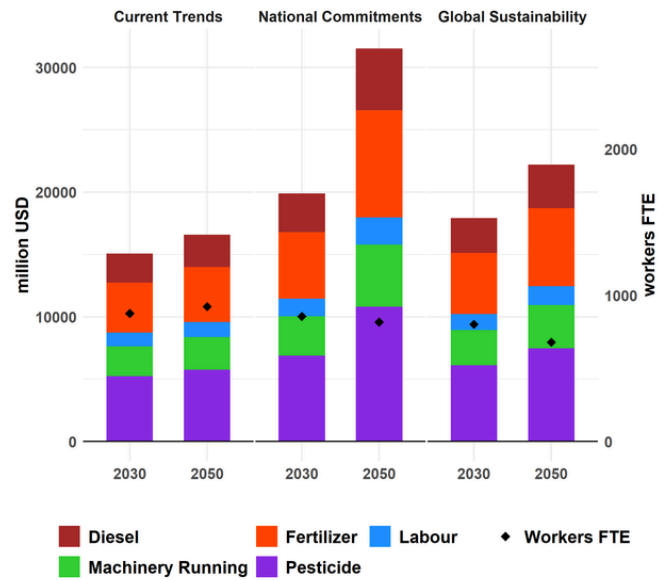


Figure 12. On farm production costs



For more detailed results and visual data, visit [www.scenathon.org](http://www.scenathon.org)

# Scenarios and assumptions

		A) CURRENT TRENDS	B) NATIONAL COMMITMENTS	C) GLOBAL SUSTAINABILITY
1. Macroeconomics	1.1) GDP per capita	SSP2	SSP2	SSP2
	1.2) Population	SSP2	Due to Ukraine representing more than half of the population in the region (~54%), we will choose a more conservative option for population changes given the <a href="#">declining population</a> and implications from the war where migration flows have increased, and the instability may reduce population growth in general. Also, Ukraine is <a href="#">reported to continue to urbanize</a> despite the declining population. So, the combination of the above led to the option of SSP2 for the population scenario.	Same as National Commitments
	1.3) Inflation	Current dollar: prices expressed in current terms (current dollar around the year 2020)	<p>According to the National Bank of Ukraine, Ukraine's <a href="#">inflation is forecasted</a> at:</p> <p>2023: 18.7%</p> <p>2024: 10.4%</p> <p>2025: 6.7%</p> <p>According to the World Bank, Ukraine's <a href="#">inflation</a> was:</p> <p>2020: 2.7%</p> <p>2021: 9.4%</p> <p>2022: 20.2%</p> <p>Given the importance of the country in the region, in terms of production volumes and production input requirements (and corresponding expenditure to purchase the inputs), we will use the average of the years during and after the war (2022 to 2025) for Ukraine (~14%) and multiply the CPI 2020 value to create a custom price scen for 2025 and then onwards we will set it to average observed as according to the forecasts inflation will contract to pre-crises levels. To implement this, we choose the average inflation scenario (which is the assumed CPI change for most years) and manually change avg CPI change for the 2025 period to (CPI =~42) to reflect a price shifter of 1.14 (and reflect the 14% increase of inflation mentioned above).</p>	Same as National Commitments
	1.4) Inequalities			

# Scenarios and assumptions

		A) CURRENT TRENDS	B) NATIONAL COMMITMENTS	C) GLOBAL SUSTAINABILITY
<b>2. Land</b>	<b>2.1)</b> Constraints on agricultural expansion/deforestation	No deforestation	No explicit policy target available however, the countries are assumed to keep up with international efforts to reduce or halt deforestation. As such, the no deforestation option was selected	Same as National Commitments
	<b>2.2)</b> Afforestation, and forest plantations targets	BonnChallenge	BonnChallenge pledges (total of 350,000 ha) were limited so, we assumed more ambitious increase of forest by 20% (6 Mha), no time horizon so, set to 2050.	Same as National Commitments
	<b>2.3)</b> Urban and settlements area	No change	No change	No change
	<b>2.4)</b> Protected areas	No change	No change	PAExpansion
<b>3. Productivity and management</b>	<b>3.1)</b> Crop productivity for the key crops	No Growth	Moderate (Middle) productivity growth selected due to current conflict in Ukraine (which is the most important agricultural country of the region).	High Growth
	<b>3.2)</b> Cropland under agroecological practices	No change	No change	No change
	<b>3.3)</b> Livestock productivity for the key livestock products	No growth	Middle Growth	High Growth
	<b>3.4)</b> Pasture stocking rate	No change	No change	High growth
	<b>3.5)</b> Forest management			
<b>4. Trade</b>	<b>4.1)</b> Share of consumption which is imported for key imported products (%)	For trade, we choose no adjustment to reflect current disruptions due to the Ukraine – Russia conflict.	No import target declaration available. We choose the stable imports scenario.	Same as National Commitments
	<b>4.2)</b> Evolution of exports for key exported products (1000 tons)	For trade, we choose no adjustment to reflect current disruptions due to	Based on observed reductions in trade (UNcomtrade database) for the three major exported goods in Ukraine (maize, wheat and sunflower oil) a temporary reduction is imposed for the next 2 time steps. The percent decrease from 2020 to 2022 (which is when the disruption started), was 10%,	Same as National Commitments

# Scenarios and assumptions

		A) CURRENT TRENDS	B) NATIONAL COMMITMENTS	C) GLOBAL SUSTAINABILITY
		the Ukraine – Russia conflict.	39% and 38% for maize, sunflower oil and wheat respectively. The average percent decrease in export quantities from Ukraine for these crops in the same period was ~30%. Exports before 2020 are based on historical values (around the year 2010). Exports for 2020 increase by a factor of 1.25, compared to the historical values. Then, exports for 2035 onwards are expected to increase by a factor of 1.5 through to 2050.  Given that the major exporter (Ukraine) is forecasted to recover its production in the long run, we choose the option of trade adjustment for the region.	
5. Food	5.1) Average dietary composition	Current Situation	In the national pathway scenario we introduce a new diet in the national pathway scenario which is the average of the current diet (taken from <a href="#">FAO Food balance sheets</a> ) and the EAT-Lancet average diet. Due to the current consensus, we select a delayed and gradual implementation for this target which starts taking place after 2035. In the sustainable pathway we use the latter as the targeted diet.	EAT Lancet Average.
	5.2) Share of food consumption which is wasted at household level	Current Situation	No explicit target but assume that countries will attempt to minimize food waste, in line with global efforts to decrease food losses.  No declaration available for food waste reductions. We choose the current levels.	Same as National Commitments
6. Biofuels	6.1) Targets on biofuel and/or other bioenergy use			
	6.2) Targets on other non-food use			
7. Water	7.1) Irrigated crop area	No growth	No growth	No growth